

REMARKS/ARGUMENTS

Claims 1-3, 17 and 18-21 are active. Claims, 1, 17 and 18 now describe a can having a can wall and a bottom cover as disclosed in the first paragraph [0014] at the top of page 16 of the specification. In claim 1, “press-forming an anode material that is a zinc alloy at a temperature ranging from 120°C to 210°C to make an anode zinc can” finds support in section (5) near the bottom of page 6 of the specification; a zinc alloy that comprises 98.7% to 99.8% by mass zinc, 0.1% to 0.7% by mass of bismuth and contains 70 ppm or less of lead is disclosed in section (10) on the next page 7; “a longitudinal cross-section of the can wall of the anode zinc can has an average crystal grain diameter of 8 µm to 25 µm” finds support in section (10) on page 7 of the specification. Claim 2 finds support on page 17 in paragraph [0043] which describes hexagonal and circular pellets. Claim 3 finds support on page 24, line 12. No new matter is believed to have been added. The magnesium content recited in claim 17 and the content of other elements named in claim 18 find support on page 5 in section (2) of paragraph [0007]. The cylindrical walls of claims 19-21 are described in paragraphs [0043] and [0047]. Favorable consideration of this amendment and allowance of this case are respectfully requested.

Interview Summary Record

The Applicants thank Examiners Marks and Yuan for the courteous and helpful interview of May 3, 2010. The Examiners suggested further amendments to the claims to attempt to avoid the description and prior art rejections and agreed to consider possible structural differences produced by extrusion, punching and deep-drawing if these affect crystal or grain structure when performed within the temperature range required by the claims. The teachings of Hikata were reviewed. The Applicants maintained that this reference did not suggest press-forming a zinc can within the temperature range required by

the present claims. It was agreed that there was ambiguity in the machine translation of this document, especially around paragraphs 11-14. The Examiner kindly indicated that a human translation this section of Hikata would be provided to supplement the machine-translation.

Restriction/Lack of Unity/Election

The Applicants previously elected with traverse **Group I**, claims 1-3, directed to a method for making a battery. Claims 4-7, drawn to a battery, were withdrawn from consideration and have now been cancelled without prejudice to their appearance in a divisional application. The requirement has been made FINAL. The Applicants respectfully request that the claims of the nonelected group(s) or other withdrawn subject matter which depend from or otherwise include all the limitations of an allowed elected claim, be rejoined upon an indication of allowability for the elected claim, see MPEP 821.04.

Rejection—35 U.S.C. §112, first paragraph

Claims 1-3 were rejected under 35 U.S.C. 112, first paragraph, as lacking adequate written description of the phrase “to which indium is not added”. This rejection is moot in view of the amendment of claim 1.

Rejection—35 U.S.C. §103(a)

Claims 1-3 were rejected under 35 U.S.C. §103(a) as being unpatentable over Batey, WO 00/77868, in view of Hikata, et al., JP 07-094193 and Kejha, et al., U.S. 2004/0018425.

Batey cannot render the invention obvious because it does not disclose or suggest “an anode zinc can, which has a can wall and a bottom cover” as required by claim 1.

Batey is directed to producing a foil and does not disclose processing an alloy pellet into a can. The Batey foil is for use in an alkaline battery, includes 50 to 500 ppm bismuth,

involves production of a less brittle foil that to be of practical use must be “capable of being bent or flexed through a small bend radius” (page 2, lines 26-27). However, Batey is silent about the properties of an anodic zinc alloy useful for making battery cans, such as those produced by pressforming or by extruding, punching and deep drawing, processes that place a large amount of strain or stress on the alloy. There was no reasonable expectation of success in Batey for producing a battery can using a zinc-bismuth alloy by press-forming.

The two secondary references were applied to teach that “forming the negative electrode into an electrode can” is conventional (OA, page 5, lines 3-5) and that zinc alloys containing bismuth may be mechanically worked up at a temperature of 180°C to 220°C to decrease cracking or chipping (OA, page 5, bottom of 1st paragraph).

While Hikata is relied upon for teaching working up an zinc-bismuth alloy, the Examiner has not established that it discloses a process of press-forming a zinc-bismuth alloy into a can at a temperature of 120°C to 210°C or that it discloses a method for manufacturing an anode can “wherein a longitudinal cross-section of the can wall of the anode zinc can has an average crystal grain diameter of 8 μm to 25 μm ” or provide a reasonable expectation of success for a method of making such a can that has the superior physical properties shown in the experimental data of record.

The machine-translation of Hikata¹ paragraph [0013] while mentioning “a temperature of 180-220***” does not disclose “press-forming an anode material that is a zinc alloy at a temperature ranging from 120°C to 210°C to make an anode zinc can” at the required temperature ranging from 120°C to 210°C. Rather the temperature described in the machine translation is that of a heating roller press that produces a 5-mm-thick board, not a zinc can. The decreased chance of cracking or chipping mentioned by the Examiner on page 5, 2nd paragraph, of the OA refers to “an alloy plate at the time of rolling” and not to a Zn-Bi

¹ Human translation not yet available on PAIR.

can. There is no suggestion in Hikata at all for producing a can by mechanical means at a temperature of 100-250°C (or at 120°C to 210°C as required by the invention), nor any reasonable expectation of success for producing a can having the average grain diameter required by claim 1, or for the superior properties achieved by producing a zinc-bismuth can having this average grain diameter.

Kejha was relied upon for teaching the process of extruding and deep-drawing (OA, page 3, lines 14, *ff.*), but does not disclose the other aspects of the invention, such as the importance of the type of Zn-Bi alloy and the processing temperature range.

None of the prior art discloses or suggests selecting the *temperature range of 120 to 210 degrees C* required by the present claims for making a Zn-Bi or Zn-Bi *can* of the invention. Selection of this temperature range is important because it produces a can that is less brittle and more corrosion resistant than conventional battery cans. Thus, bismuth (Bi) can be incorporated into the zinc battery cans in amounts sufficient to provide corrosion resistance while maintaining the strength of the battery can wall. In contrast, conventional batteries made of zinc alloys that incorporate 1,000 to 7,000 ppm bismuth have inferior properties since the amount of bismuth in these alloys causes excessive crystallization when the anode cans are made at conventional 250-350°C temperatures rendering the cans brittle. Brittle cans leak.

The inventors have found a way to make zinc-bismuth anode cans that are less brittle by controlling the amount of crystallization in the zinc-bismuth can wall. The differences in the amount of crystallization between battery containers according to the invention and those made at higher temperatures is clearly shown by comparing Fig. A and Fig. B which appear in a prior response. These photos of battery containers containing a lot of bismuth were taken by a metallurgical microscope. Fig. A (comparative) shows structural features of conventional Zn-Bi alloy cans processed at a higher temperature ranging from 250-350°C,

than those of the invention, shown in Fig. B. As evident from Fig. A, there are coarse particles having diameters of 500-1,000 μm , however, no such particles are seen in Fig. B. The structural differences between cans formed at higher press-forming temperatures between 250-350°C are depicted in the photographs. These photos show the relatively large grain size resulting from press-forming a can at a higher temperature. The large grain size causes cracking and corrosion. In distinction, the invention provides a can wall having a smaller grain size that is corrosion- and crack-resistant. None of the prior art suggested or provided a reasonable expectation of success for the claimed methods of producing Zn-Bi cans having superior strength and corrosion resistance of the invention. For all of the reasons above, this rejection cannot be sustained.

Conclusion

This application presents allowable subject matter and the Examiner is respectfully requested to pass it to issue. The Examiner is kindly invited to contact the undersigned should a further discussion of the issues or claims be helpful.

Respectfully submitted,

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